

ANNEX D
APPENDIX B

M1120A4, HEAVY EXPANDED MOBILITY TACTICAL TRUCK (HEMTT) KIT
SPECIFIC REQUIREMENTS

Revision	Date	Pages	Description
Draft 1.0	9 April 2012	ALL – Ron Swanson	Formating, insert revision table and acronyms. Verified references.
Draft 1.1	30 April 2012	8	Describe Flatrack and ISO container dynamics.
Draft 1.1	23 May 2012	ALL- Ron Swanson	Corrected SRD references
1.2	23 Aug 2012	CDT Team	CDT Team input from Draft RFP
1.3	22 Jan 2013	2.0 Reference	Pat Hart - Update Common SRD reference
2.0	27 Jan 2016	ALL – Pat Hart	Match currently fielded TWV vehicle variants

A-1.0 Scope

This appendix to the Common Driver Trainer (CDT) Tactical Wheeled Variant (TWV) System Requirements Document (SRD) describes the requirements for the M1120A4 Heavy Expanded Mobility Tactical Truck (HEMTT) specific kit. Each kit includes the vehicle specific driver's compartment hardware and simulation software needed to convert the base CDT TWV to match a specific vehicle's physical and functional characteristics.

A-2.0 Applicable Documents

- TM 9-2320-345-10, Technical Manual Operator's Manual for, Truck, Load Handling System (LHS), W and W/O Winch, 8x8 M1120A4, dated October 2008
- TM 9-2330-3385-10, Technical Manual Operators's Manual, Palletized Load System Trailer (PLST), M1076, dated 30 April 2009.
- TM 9-3990-206-10, Technical Manual Operator's Manual, Palletized Load System (PLS) Flatrack, M1077/M1077A1, dated 30 April 2009
- TM 9-2320-345-10, Technical Manual Operator's Manual for Truck, Load Handling System (LHS), 8X8, M1120A4 dated 25 February 2014
- System Requirements Document for the Common Driver Trainer System, PRF-PT-00430, Version 6.0, dated 27 Jan 2016.
- System Requirements Document for the Tactical Wheeled Variant (TWV) Including Vehicle Specific Kits for the Common Driver Trainer (CDT) System, PRF-PT-00580, Version 2.0 dated 27 Jan 2016.

In the event of a conflict between the requirements of this document and those contained in the documents above, the requirements contained in this document take precedence.

A-3.0 Requirements

A-3.1 System Level Requirements

The M1120A4 HEMTT kit shall consist of hardware and software components which will reconfigure the CDT TWV to support driver training for drivers of the M1120A4 HEMTT vehicle. The M1120A4 HEMTT specific modules shall consist of the simulated reconfigurable driver's compartments, the instruments and controls for the driver, the software required to operate the driver's compartment, and the software to provide the specific vehicle performance in response to driver inputs and interaction with the Common Modules.

Unless specifically modified in this appendix, the requirements specified for the CDT TWV baseline vehicle shall apply when the CDT TWV is configured as a M1120A4 HEMTT. In case of a conflict between the requirements of the CDT TWV SRD and the

requirements of this appendix for the M1120A4 HEMTT, the requirements of this appendix shall take precedence when testing the M1120A4 HEMTT configuration.

A-3.1.1 Common Module Requirements

A-3.1.1.1 Instructor Operator Station (IOS)

The IOS shall control the operation of the CDT TWV, select/modify training scenarios, monitor simulated vehicle status (e.g., instruments, switches, etc.), monitor driver trainee performance and manage student records in accordance with the requirements of the System Requirements Document for the Tactical Wheeled Variant (TWV) Including Vehicle Specific Kits for the Common Driver Trainer (CDT) System, PRF-PT-00580.

A-3.2 Variant Requirements

The M1120A4 HEMTT kit shall include simulation hardware and software that replicates the controls, instruments, vehicle operation and vehicle dynamics of the M1120A4 HEMTT and the M1076 PLST (trailer). The main components of the driver's compartment are the controls, instruments, switches, panels, seating and physical structure of the M1120A4 HEMTT necessary to accomplish the required training tasks. When configured as a M1120A4 HEMTT driver's compartment, the simulation software shall provide the driver's compartment control and switch interaction and simulator response for the controls, instruments, switches and panels necessary to accomplish the required TWV training tasks. The simulation software shall provide realistic vehicle dynamic responses to driver control inputs and simulated training environment interactions. The driver's compartment shall provide the status of hardware and software to the CDT system through the defined interfaces during CDT daily readiness tests. During initialization, the system shall check the installed configuration and provide an indication to the instructor/operator at the IOS the specific TWV configuration installed and provide an error message if there are any reconfigurable component mismatches or components not installed.

A-3.2.1 Variant Training Requirements

The training requirements for the M1120A4 HEMTT shall be the same as the training requirements specified in paragraph 3.2.1 of System Requirements Document for the Tactical Wheeled Variant (TWV) Including Vehicle Specific Kits for the Common Driver Trainer (CDT) System, PRF-PT-00580.

A-3.2.1.1 Malfunction/Emergency Condition Training Requirements

The malfunction/emergency condition training requirements for the M1120A4 HEMTT shall be the same as the malfunction/emergency condition training requirements specified in paragraph 3.2.1.1 of System Requirements Document for the Tactical Wheeled Variant

(TWV) Including Vehicle Specific Kits for the Common Driver Trainer (CDT) System, PRF-PT-00580.

A-3.2.2 Specific Reconfigurable TWV Module Requirements

A-3.2.2.1 Simulated Driver Compartment

The simulated driver compartment for the M1120A4 HEMTT shall be the same as the simulated driver compartment specified in paragraph 3.2.2.1 of System Requirements Document for the Tactical Wheeled Variant (TWV) Including Vehicle Specific Kits for the Common Driver Trainer (CDT) System, PRF-PT-00580.

A-3.2.2.1.1 Driver's Compartment Subsystem Common Components

The driver's compartment subsystem common components for the M1120A4 HEMTT shall be the same as the driver's compartment subsystem common components specified in paragraph 3.2.2.1.1 of System Requirements Document for the Tactical Wheeled Variant (TWV) Including Vehicle Specific Kits for the Common Driver Trainer (CDT) System, PRF-PT-00580.

A-3.2.2.1.1.1 Driver's Door

The driver's door for the M1120A4 HEMTT shall be the same as the driver's door specified in paragraph 3.2.2.1.1.1 of System Requirements Document for the Tactical Wheeled Variant (TWV) Including Vehicle Specific Kits for the Common Driver Trainer (CDT) System, PRF-PT-00580.

A-3.2.2.1.1.2 Steering Column and Wheel

The steering column and wheel for the M1120A4 HEMTT shall be the same as the steering column and wheel specified in paragraph 3.2.2.1.1.2 of System Requirements Document for the Tactical Wheeled Variant (TWV) Including Vehicle Specific Kits for the Common Driver Trainer (CDT) System, PRF-PT-00580. The turn signal control stalk shall move up for right turns and down for left turns. The turn signal stalk end push button shall be programmed to switch between high and low beam service lights (i.e., service light dimmer switch). The steering wheel center button shall be programmed to activate the vehicle horn when pushed. The hazard lights switch shall be located under the turn signal lever (away from the steering wheel). A Trailer Handbrake control Lever is found on the right side of the steering column.

A-3.2.2.1.1.3 Throttle

The throttle for the M1120A4 HEMTT shall be the same as the throttle specified in paragraph 3.2.2.1.1.3 of System Requirements Document for the Tactical Wheeled

Variant (TWV) Including Vehicle Specific Kits for the Common Driver Trainer (CDT) System, PRF-PT-00580.

A-3.2.2.1.1.4 Service Brake Pedal

The service brake pedal for the M1120A4 HEMTT shall be the same as the service brake pedal specified in paragraph 3.2.2.1.1.4 of System Requirements Document for the Tactical Wheeled Variant (TWV) Including Vehicle Specific Kits for the Common Driver Trainer (CDT) System, PRF-PT-00580.

A-3.2.2.1.1.5 Driver's Seat

The driver's seat for the M1120A4 HEMTT shall be the same as the driver's seat specified in paragraph 3.2.2.1.1.5 of System Requirements Document for the Tactical Wheeled Variant (TWV) Including Vehicle Specific Kits for the Common Driver Trainer (CDT) System, PRF-PT-00580.

A-3.2.2.1.1.6 DVE Night Vision Device

The DVE night vision device for the M1120A4 HEMTT shall be the same as the DVE night vision device specified in paragraph 3.2.2.1.1.6 of System Requirements Document for the Tactical Wheeled Variant (TWV) Including Vehicle Specific Kits for the Common Driver Trainer (CDT) System, PRF-PT-00580.

A-3.2.2.1.1.7 Interchangeable Dashboard Panels and Equipment

The dash panel(s) for the M1120A4 HEMTT shall consist of one or more removable assemblies that replicate the form and function of the M1120A4 HEMTT vehicle as described in TM 9-2320-345-10, Technical Manual Operator's Manual, Truck, Load Handling System (LHS), W and W/O Winch, 8x8 M1120A4, dated October 2008. Unless specified, the items below are to be functional. The panels/clusters that are replicated are as follows:

- a. Check Engine Indicator
- b. Engine Oil Pressure Gauge
- c. Low Engine Oil Pressure Indicator
- d. High Engine Coolant Temperature Indicator
- e. Engine Coolant Temperature Gauge
- f. Speedometer
- g. Tachometer
- h. Air Filter Restriction Indicator
- i. Front Air Pressure Gauge
- j. Low Fuel Indicator
- k. Fuel Gauge

- l. Check Transmission Indicator
- m. High Transmission Temperature Indicator
- n. Transmission Oil Temperature Guage
- o. Liquid Crystal Display (LCD)
- p. Mode (M) Button
- q. Trip (T) Button
- r. Odometer
- s. Trip / Hrs display
- t. Battery Voltage
- u. Drive Mode Display
- v. Rear Air Pressure Gauge
- w. Brake System Failure (Low Air) Indicator
- x. Work Light Indicator (non-functional)
- y. Stop Engine Indicator
- z. Beacon Light Indicator (non-functional)
- aa. Clearance Light Indictator (non-functional)
- bb. Spare Tire Loose Indicator (illuminate on vehicle start up only)
- cc. Fan Speed Knob (non-functional)
- dd. Temperature Control Knob (non-functional)
- ee. Air Flow Direction Knob (non-functional)
- ff. Master Light Switch
- gg. Parking Brake Control Switch
- hh. Trailer Air Supply Control Switch
- ii. Beacon Light Switch (non-functional)
- jj. Engine Brake On/Off Switch
- kk. Engine Brake High/Medium/Low Switch (Three-Position)
- ll. High Idle Switch (non-functional)
- mm. Ignition/Engine Stop Switch
- nn. Work Light Switch (non-functional)
- oo. Chem Alarm Switch (non-functional)
- pp. B.O. Select Switch
- qq. B.O. Lights Switch (Three-Position)
- rr. Automatic Traction Control Indicator (ATC)
- ss. Dash Dimmer Switch (two position momentary)
- tt. Traction Control Switch
- uu. Gas Particle Filter Unit Switch (non-functional)
- vv. Master Lighting Switch (Three-Position)
- ww. Dome Light Switch (non-functional)
- xx. Windshield Washer Switch (non-functional)
- yy. Windshield Wiper Switch (non-functional)
- zz. Ign/Eng Stop Switch
- aaa. Eng Start Switch
- bbb. Parking Brake Indicator
- ccc. Trailer ABS Indicator
- ddd. High Beam Indicator Light

eee.	HydraulicSelector Switch
fff.	LHS Joy stick
ggg.	Self Recovery Winch Lever (non-functional)
hhh.	Transfer case shift
iii.	Inter Axle / 8X8 Switch
jjj.	Hydraulic Enable Switch
kkk.	Aux Hyd Switch
lll.	Left Turn Indicator
mmm.	Vehicle ABS Indicator
nnn.	Right Turn Signal
ooo.	Work Light Indicator (non-functional)
ppp.	Overspeed Indicator
qqq.	Stop Engine Indicator
rrr.	Automatic Traction Control Indicator
sss.	ABS Disable Indicator
ttt.	Low Hyd Oil Indicator
uuu.	High Idle Indicator (non-functional)
vvv.	Charging System Indicator
www.	Engine Brake Enable Indicator
xxx.	Transfer Case Indicator (non-functional)
yyy.	8X8 Indicator
zzz.	Inter Axle Indicator (non-functional)
aaaa.	Rear Diff Lock Indicator (non-functional)
bbbb.	Front Diff Lock Indicator (non-functional)
cccc.	LHS Indicator
dddd.	LHS NO Trans Indicator
eeee.	LHS Overload Indicator
ffff.	Main Hyd Enable Indicator
gggg.	Suspension Air Indicator (non-functional)
hhhh.	Emergency Steering Indicator (non-functional)
iiii.	Flat Rack Indicator
jjjj.	Aux HYD Enable (non-functional)
kkkk.	ABS Off-Rd Switch
llll.	Trans Selector

A-3.2.2.1.2 M1120A4 HEMTT Specific Driver's Compartment Components

The CDT TWV M1120A4 HEMTT cab shall replicate the M1120A4 HEMTT cab.

A-3.2.2.1.2.1 Specific Driver's Compartment Hardware Components

The M1120A4 HEMTT kit shall include the specific hardware components listed in paragraph 3.2.2.1.1.7, Interchangeable Dashboard Panels and Equipment above.

A-3.2.2.1.2.2 Specific Driver's Compartment Software Components

The reconfigurable Driver's assembly software shall stimulate or simulate all required M1120A4 HEMTT dashboard controls and indicators through the cab Input / Output (I/O) subsystem.

All controls and indicators shall operate in accordance with TM 9-2320-345-10 operator's manual.

A-3.2.2.2 Vehicle Simulation

A-3.2.2.2.1 Vehicle Dynamics Performance

The M1120A4 HEMTT kit software shall simulate the M1120A4 HEMTT vehicle dynamics to the level of detail required to support the training tasks in paragraph 3.2.1. Vehicle dynamics shall include steering feel, steering response, acceleration, deceleration, braking and suspension response. The vehicle dynamics simulation shall provide models of the power train (e.g., engine, transmission, etc.), suspension (e.g., springing, damping, range of travel, etc.), and the hull of the M1120A4 HEMTT vehicle. The parameters for these models shall be evaluated at 60 Hz to assure smooth and accurate simulation. Terrain topography and surface characteristics shall be determined and combined with control inputs from the driver compartment to provide inputs to the models of the engine, transmission, steering, brakes, suspension, and hull. The vehicle dynamics simulation results shall drive the visual displays, motion cues, aural cues, and instrumentation in the driver compartment.

A-3.2.2.2.1.1 Engine Model

The engine model for the M1120A4 HEMTT shall be the same as the engine model specified in TM 9-2320-345-10, Technical Manual Operator's Manual for Truck, Load Handling System (LHS), W and W/O Winch, 8x8 M1120A4, dated October 2008.

A-3.2.2.2.1.2 Transmission Model

The transmission model for the M1120A4 HEMTT shall be the same as the transmission model specified in TM 9-2320-345-10, Technical Manual Operator's Manual for Truck, Load Handling System (LHS), W and W/O Winch, 8x8 M1120A4, dated October 2008.

A-3.2.2.2.1.3 Steering and Brake Model

The steering and brake model shall be a physics-based model of the actual real world performance of the M1120A4 HEMTT vehicle. The position of the service brake pedal and the engaged/disengaged status of the parking brake shall be input to the brake model. Appropriate real time brake force parameters shall be determined and applied to the CDT motion control software.

A-3.2.2.2.1.4 Suspension Model

The model of the suspension system shall include computation of the forces acting on the suspension components. The effects of the terrain, including slope, height and surface roughness shall be combined with the forces due to the mass and momentum of the hull to determine the suspension force at each wheel acting on the hull. Pitch torque and roll torque shall be computed as inputs to the hull model by transferring the combined forces on the own vehicle through the damping and spring characteristics of the suspension.

A-3.2.2.2.1.5 Hull Model

The position, velocity, and acceleration of the own vehicle Center of Gravity (CG) shall be determined in six degrees of freedom by the hull model. Inputs from the power train, suspension, and terrain models shall be combined to resolve the updated vehicle position and derive the velocities and accelerations.

A-3.2.2.2.2 Trailer Dynamics Performance

The M1120A4 HEMTT kit software shall simulate the vehicle dynamics of the M1076 Palletized Load System Trailer (PLST). The trailer vehicle dynamics shall include the trailer size, weight, CG, suspension characteristics and attachment to tow vehicle. The trailer tracking and turning shall respond correctly to tow vehicle dynamics in both forward and reverse movement. The trailer shall be modeled in an empty, half and full load configurations with the weight evenly distributed. The parameters for the trailer dynamic model shall be evaluated at 60 Hz to assure smooth and accurate simulation. Terrain topography and surface characteristics shall be determined and combined with inputs from the tow vehicle to determine trailer vehicle dynamics. The trailer vehicle dynamics simulation results shall drive the visual displays, motion cues, aural cues, and instrumentation in the driver compartment as applicable.

A-3.2.2.2.3 Flatrack and International Standards Organization (ISO) Container Dynamics Performance

The kit software shall simulate the characteristics of the M1077/M1077A1 PLS Flatrack and an ISO container. The vehicle dynamics shall include the size weight and handling characteristics of the PLS Flatrack or ISO container loaded on the M1120A4 HEMTT. The Flatrack and ISO container (20' X 8' X 8') shall be modeled in an empty, half and full load configuration with the weight evenly distributed. When the vehicle is properly aligned with the respective load in conjunction with the ground guide and the Load Handling Unit (LHU) or Container Handling Unit (CHU) is deployed properly, the CDT will automatically connect the load. The driver shall control the operation of the LHS to load the Flatrack or the CHU to load the ISO container and travel locks. The M1120A4 HEMTT vehicle dynamics shall exhibit proper vehicle motions encountered during loading along with the aural cues of loading. After loading, the vehicle dynamics shall

then reflect the vehicle with the load attached. The rear view mirrors shall show proper visual movement of the load during loading and also the stable secured load after loading. The reverse visual imagery, aural cues and motion simulation response shall be provided when unloading the load.

A-3.2.2.2.4 Malfunctions and Emergency Conditions

The malfunctions and emergency conditions for the M1120A4 HEMTT shall be the same as the malfunctions and emergency conditions specified in paragraph 3.2.2.2.2 of System Requirements Document for the Tactical Wheeled Variant (TWV) Including Vehicle Specific Kits for the Common Driver Trainer (CDT) System, PRF-PT-00580.

A-3.2.2.2.3 Visual Simulation

The visual simulation for the M1120A4 HEMTT shall be the same as the visual simulation specified in paragraph 3.2.2.3 of System Requirements Document for the Tactical Wheeled Variant (TWV) Including Vehicle Specific Kits for the Common Driver Trainer (CDT) System, PRF-PT-00580.

A-3.2.2.3.1 Visual Scenes

The M1120A4 HEMTT kit shall utilize the CDT visual environment data bases as specified in the System Requirements Document for the Common Driver Trainer System, PRF-PT-00430. When configured as a M1120A4 HEMTT, the CDT TWV shall have any fixed obstructions (e.g., hull or structural components of the M1120A4 HEMTT) visible in the driver's field of view (FOV) displayed in the visual scene as a fixed entity. The simulated eye point height of the displayed image shall be the same as that realized by the driver in the operational vehicle.

A-3.2.2.3.2 Display Configuration

The display configuration for the M1120A4 HEMTT shall be the same as the display configuration specified in paragraph 3.2.2.3.2 of System Requirements Document for the Tactical Wheeled Variant (TWV) Including Vehicle Specific Kits for the Common Driver Trainer (CDT) System, PRF-PT-00580.

A-3.2.2.3.3 Sensor Image Simulation

The sensor image simulation for the M1120A4 HEMTT shall be the same as the sensor image simulation specified in paragraph 3.2.2.3.3 of System Requirements Document for the Tactical Wheeled Variant (TWV) Including Vehicle Specific Kits for the Common Driver Trainer (CDT) System, PRF-PT-00580.

A-3.2.2.3.4 Visual Effects

The visual effects for the M1120A4 HEMTT shall be the same as the visual effects specified in paragraph 3.2.2.3.4 of System Requirements Document for the Tactical Wheeled Variant (TWV) Including Vehicle Specific Kits for the Common Driver Trainer (CDT) System, PRF-PT-00580.

A-3.2.2.4 Aural Cue and Communications

The aural cues and communications for the M1120A4 HEMTT shall be the same as the aural cues and communications specified in paragraph 3.2.2.4 of System Requirements Document for the Tactical Wheeled Variant (TWV) Including Vehicle Specific Kits for the Common Driver Trainer (CDT) System, PRF-PT-00580.

A-3.2.2.5 Scoring Criteria

The scoring criteria for the M1120A4 HEMTT shall be the same as the scoring criteria specified in paragraph 3.2.2.5 of System Requirements Document for the Tactical Wheeled Variant (TWV) Including Vehicle Specific Kits for the Common Driver Trainer (CDT) System, PRF-PT-00580.

A-4.0 Acronyms List

CDT	Common Driver Trainer
CG	Center of Gravity
CHU	Container Handling Unit
FOV	Field of View
HEMTT	Heavy Expanded Mobility Tactical Truck
Hz	Hertz
I/O	Input / Output
IOS	Instructor Operator Station
ISO	International Standards Organization
LHS	Load Handling System
LHU	Load Handling Unit
MTVT	Medium Tactical Vehicle Trailer
PLS	Palletized Load System
PLST	Palletized Load System Trailer
SRD	System Requirements Document
TWV	Tactical Wheeled Variant
TM	Technical Manual
W	With
W/O	Without